

Ortodontsko liječenje i disfunkcija temporomandibularnoga zgloba

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Sažetak

Tijekom ortodontskoga liječenja često se javlja zabrinutost o vezi liječenja i razvoja simptoma temporomandibularne disfunkcije. Svrha je ovoga rada dati pregled literature u svezi s na mogućim utjecajem ortodontskoga liječenja na nastanak disfunkcije temporomandibularnoga zgloba.

Iz danoga pregleda literature vidljivo je kako je hipoteza da ortodontsko liječenje uzrokuje temporomandibularne disfunkciju zbog distalnoga pomaka kondila vjerojatno neutemeljena. Klinička ispitivanja daju rezultate iz kojih proizlazi da ortodontsko liječenje ima malu ulogu u pogoršanju ili nastanku temporomandibularne disfunkcije kada se pacijenti u kojih je provedeno ortodontsko liječenje uspoređuju s neliječenim pacijentima s ortodontskim anomalijama ili bez njih, ili kada se uspoređuju različiti oblici liječenja, a longitudinalna istraživanja govore čak o redukciji znakova TMD-a u ortodontski liječenih pacijenata.

Ključne riječi: ortodontsko liječenje, temporomandibularna disfunkcija

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Zadnjih godina aktualizirano je pitanje povezanosti ortodontskoga liječenja i nastanka disfunkcije temporomandibularnoga zgloba (u daljnjem tekstu TMD), ali unatoč mnogim istraživanjima to pitanje i dalje zabrinjava ortodonte.

Svrha je ovoga rada dati pregled literature koja se odnosi na mogući utjecaj ortodontskoga liječenja na nastanak disfunkcije temporomandibularnoga zgloba.

Razni oblici ortodontskoga liječenja smatraju se rizičnim etiološkim čimbenicima koji mogu utjecati na distalni pomak kondila te na nastanak smetnji u temporomandibularnome zglobu i u okolnim anatomske strukturama (1).

Veza između okluzije i TMD-a isto je tako oprečno prikazana u literaturi. Neki autori tvrde da je okluzija primarni etiološki čimbenik u nastanku TMD-a (2,3), a drugi navode da ona u tome ima tek neznatnu ulogu (4,5). Uzroci disfunkcije temporomandibularnoga zgloba zapravo su multifaktorijski.

Mnogobrojna epidemioška ispitivanja navode da subjektivni simptomi i klinički znakovi, kao što su bol na palpaciju, napetost mišića, zvukovi u zglobu, ograničena pomičnost mandibule, mogu nastati i u zdravih osoba koje se nikada nisu ortodontski liječile, a pod utjecajem su etničkog, socijalnog i psihičkog statusa (6-9).

Mnoge studije ističu postojanje mandibularne disfunkcije i u zdrave djece i u adolescenata u kojih nije provedeno ortodontsko liječenje, te navode da se subjektivni simptomi i klinički znakovi pojačavaju porastom dobi. Klinički simptomi TMD-a javljaju se čak u 75% mlade populacije (10-13). Egemark-Eriksson, Carlson i Ingervall (14) navode da se postotak simptoma povećava s 30% na 60% između 7. i 15. godine života, te da se češće javljaju u žena.

Kako postotak simptoma ovisi o kriterijima, dijagnostičkim metodama koje se provode, te o izboru samog ispitivanog uzorka, longitudinalna ispitivanja daju najvjerodostojnije rezultate (15).

Povijesno gledano, ortodonti su u prvome redu bili orijentirani na liječenje u adolescenata, no zadnjih se je desetljeća povećao broj djece u mješovitoj denticiji te odraslih pacijenata koji traže ortodontsko liječenje. Povećani zahtjevi za boljom estetikom, te razvoj sofisticiranih tehnika (implantati, vođena tkivna regeneracija) uzrokom su što sve više odraslih pacijenata zahtijeva ortodontsko liječenje, a to povećava množinu pacijenata u kojih se može očekivati smetnje u tempromandibularnom zglobu (TMZ).

Nazivak tempromandibularna disfunkcija (TMD) označuje mnogobrojne subjektivne simptome i kliničke znakove koji se odnose na tempromandibularni zglob i okolne strukture. Može se reći da se radi o boli u orofacijalnoj regiji kojoj nije uzrok zub (1).

Definicija disfunkcije TMZ-a je područje koje je i danas problematično. Van der Weele i Dibbets (16) navode: "... u uporabi je mnogo definicija disfunkcije TMZ-a, a kao posljedica toga čak i kod individualnih slučajeva dijagnostika disfunkcije ovisi o samoj definiciji koja se upotrebljava".

Mnoga istraživanja koja se bave problematikom zgloba služe se Helkimo kliničkim disfunkcijskim indexom (DI) (17), koji je izvorno uveden kao epidemiološko sredstvo (18) a temelji se na pet kliničkih simptoma: smanjena pomičnost mandibule, nedostatna funkcija zgloba, bol u mišićima, bol u zglobu, bol pri kretanjama mandibule. Svaki znak ili simptom boduje se kao 0,1 ili 5. Zbroj može iznositi od 0-25. 0 = stanje bez simptoma, 1-4 = lagana disfunkcija, 5-9 = srednja disfunkcija, 10-25 = izražena disfunkcija uz smanjenu pokretljivost, luksaciju i bol.

U upotrebi je i kranio-mandibularni index koji zahtijeva dugotrajan postupak i opsežnu standardizaciju, te je zato jasniji nego Helkimo index, ali zbog svoje složenosti malo upotrebljava u ortodontskoj literaturi (18).

Tempromandibularna disfunkcija u ortodontski liječenih i neliječenih ispitanika

Najranije ispitivanje koje je provedeno kako bi se odgovorilo na pitanje dovodi li ortodontsko liječenje fiksnim ili mobilnim napravama do porasta TMD-a bilo je ono koje su proveli Sadowsky i Be Gola 1980. godine (5). Autori nisu mogli naći statistički značajnu razliku između liječenih i neliječenih pacijenata te zaključuju da fiksno ortodontsko liječenje provedeno u adolescenciji ne povećava rizik za nastanak TMD-a.

Stanje prije godine 1988. sažeo je Gianelly (19), on navodi da se evidencija koja okrivljuje ortodontsko liječenje za nastanak dugotrajnih posljedica na zglobu većinom temelji na anegdotalnim primjerima, no u zadnje vrijeme primjenom strožih kriterija i evidencije istraživanja i rezultati koji iz njih proizlaze postaju vjerodostojniji.

Koch (20) u ortodontski liječenih pacijenata adolescentne dobi jednako često nalazi zadovoljavajuće stanje bez simptoma u TMZ-u kao i u onih koji se nikada nisu ortodontski liječili.

Smith i Freer (21) uspoređuju 87 ortodontskih pacijenata liječenih fiksnom edgewise tehnikom u adolescenciji s kontrolnom skupinom koja nije bila ortodontski liječena. U simptomima između ispitivanih skupina nisu našli statistički značajne razlike osim veće čestote tihih pucketanja u zglobu liječenih osoba. Njihovi rezultati ne podupiru hipotezu o svezi između ortodontskog liječenja i TMD-a.

Egemark i Thilander (10) proveli su longitudinalno istraživanje na uzorku 293 djece u dobi od 7,11 i 15 godina. Nakon deset godina pacijenti su dobili upitnik o ortodontskom liječenju i simptomima sa strane TMZ-a. Osobe koje su se ortodontski liječile pokazuju manji postotak subjektivnih simptoma, a i Helkimo index je prema kliničkom ispitivanju u tih osoba znatno niži. Zvukovi TMZ-a isto se tako rjeđe javljaju u ortodontski liječenih pacijenata.

Olsson i Lindqvist (22) longitudinalno su ispitali 210 pacijenata u kojih je provedeno fiksno ortodontsko liječenje. Prije ortodontskoga liječenja simptome TMD-a imala je 17% pacijenata, a nakon terapije samo 7%. Zaključuju da ortodontsko liječenje u mnogih pacijenata može prevenirati ili čak spriječiti nastanak TMD-a.

Hirata, Heft, Hernandez i sur. (6) mjerili su prevalenciju i incidenciju znakova TMD-a u skupini od 102 pacijenta, prosječne dobi 15,3 godine, koja je bila ortodontski liječena. Kontrolna skupina sastojala se od 42 ispitanika, prosječne dobi 16,2 godine, koji nikada nisu bili ortodontski pacijenti. Incidencija temporomandibularnih znakova nije pokazivala statistički značajnu razliku između skupina.

Kremenak i sur. (23,24) su na longitudinalnoj studiji nastojali utvrditi vezu između disfunkcije TMZ-a i provedenog ortodontskog liječenja. Uzorak se sastojao od 109 pacijenata, prosječne dobi 16,25 godina, kod kojih je proveden fiksni tretman edgewise tehnikom. Temporomandibularni status utvrđen je prije liječenja i nakon njega, a bodovan je Helkimo indeksom. U 90% pacijenata stanje se je poboljšalo ili nije bilo nikakvih promjena u Helkimo indexu, a samo su se u 10% simptomi pogoršali (porast bodova). Zaključuju da se ortodontsko liječenje u njihovu uzorku ne smatra važnim etiološkim čimbenikom u nastanku TMD-a.

Keß (25) je uspoređivao 54 ortodontski liječena pacijenta s 52 ispitanika koji se nikada nisu ortodontski liječili. Prosječna dob uzorka bila je 25 godina. Prema Helkimo definiciji u oko 50% neliječenih ispitanika javila se ograničena pomičnost mandibule pri lateralnim kretanjama, a u ortodontski liječenih pacijenata postotak je iznosio samo 16%. Mišići: maseter, pterigoideus lateralis i temporalis isto su tako u ortodontski liječenom uzorku pokazali znatno manju frekvenciju pojave boli na palpaciju tijekom kliničkog ispitivanja. Osjetljivost zglobova pri otvaranju usta dva je puta bila češća u neliječenom uzorku. Prema Helkimo indexu 35% tretiranog i samo 10% netretiranog uzorka može se označiti - bez simptoma.

Pancherz (26) je ispitujući učinak Herbstove naprave kod 22 pacijenta s Klasom II/1 tijekom rasta našao da se udvostručio broj pacijenata osjetljivih na palpaciju u prva 3 mjeseca liječenja. No pošto je ortodontska naprava skinuta, nestali su gotovo svi simptomi, a 12 mjeseci nakon završetka liječenja broj

pacijenata sa simptomima bio je jednak kao i prije liječenja.

Paesani (27) je u 115 pacijenata sa znacima kranio-mandibularne disfunkcije napravio bilateralnu sliku s pomoću magnetske rezonance. U 78% pacijenata nađen je različit stupanj unilateralnih ili bilateralnih poremećaja, bilo u smislu pomaka i redukcije, pomaka bez redukcije diska ili artrozu.

Lieberman, Gazit, Fuchs i sur. (28) na uzorku od 369 izraelske školske djece u dobi od 10 do 18 godina ne nalaze vezu između provedenog ortodontskog liječenja i povećanja simptoma TMD-a.

Larsson i Ronnerman (29) proveli su ispitivanje na 23 švedska adolescentna pacijenta kod kojih je ortodontsko liječenje bilo provedeno 10 godina prije. U 18 pacijenata provedena je fiksna terapija, a u 5 miofunkcionalna. U 31% ispitanika klinički je ustanovljena lagana disfunkcija, a samo je jedan ispitanik (4%) imao ozbiljnu disfunkciju prema Helkimo indexu. Zaključuju da se ortodontsko liječenje može provesti bez opasnosti od nastanka TMD-a, te čak navode da može i preventivno djelovati.

Kao pravilo, ortodontsko liječenje treba odgoditi sve dok ne nestane bol orofacijalnog područja, te treba ustanoviti je li stanje TMZ-a uzrokom te boli. Pošto bol nestane te stanje postane stabilno, treba proći određeno razdoblje, najbolje oko 6 mjeseci, dok se ne započne aktivno ortodontsko liječenje (9).

Pacijent s generaliziranom muskuloskeletalnom boli (fibromijalgije, sustavske upalne bolesti; reumatski artritis i sl.) najprije mora obraditi reumatolog, a odluku kada početi aktivno ortodontsko liječenje treba donjeti u suradnji sa specijalistom.

Ako se bol u TMZ-u javi tijekom liječenja, obvezatno treba smanjiti ili potpuno ukloniti silu koju proizvodi ortodontska naprava, bilo da se radi o ekstraoralnoj vuči ili, međučeljusnome gumenom vlatku, te se aktivna terapija nastavlja tek nakon nestanka simptoma.

Iz danoga pregleda literature vidljivo je kako je hipoteza da ortodontsko liječenje dovodi do TMD-a zbog distalnoga pomaka kondila vjerojatno neutemeljena. Klinička ispitivanja daju rezultate iz kojih proizlazi da ortodontsko liječenje ima malu ulogu u pogoršanju ili nastanku TMD-a kada se pacijenti koji su ortodontski liječeni uspoređuju s neliječenim pacijentima s ortodontskim anomalijama ili bez njih, ili kada se uspoređuju razni oblici liječe-

nja, a longitudinalna istraživanja govore čak o redukciji znakova TMD-a u ortodontski liječenih pacijenata (22,30,31).

Utjecaj ekstrakcije i intermaksilarnoga gumenog vlaka na nastanak disfunkcije temporo-mandibularnoga zgloba

U novije vrijeme u literaturi nailazimo na podatke da ekstrakcija premolara u ortodontske svrhe, ekstraoralna vuča, te gumeni vlak Klase II mogu proizročiti do oštećenja TMZ-a, što je vjerojatno i razlog da se broj ekstrakcija smanjio s 37,7% od prije 5 godina na sadašnjih 29,3% (6). Smatra se da ortodontsko liječenje koje obuhvaća retruziju sjekutića nakon vađenja premolara uzrokuje posteriorni pomak kondila te simptoma TMD-a.

Witzig i Spahl (32) navode da je ekstrakcija premolara stvar prošlosti jer je uzrok smanjenoj okomitoj dimenziji okluzije te stvara patološki položaj kondila u zglobu u smislu njegova posteriornog pomaka u glenoidnoj fossi. Isti autori podupiru i tvrdnju da pacijenti s Klasom II/2 ili s retrudiranim maksilarnim sjekutićima, kao rezultatom ortodontskog liječenja imaju veći postotak TMD-a (33).

Farrar i McCarty (34) smatraju posteriorni položaj kondila predisponirajućim čimbenikom u anteriornom pomaku diska, dok Grummons (35) kao čimbenik u nastanku TMD-a navodi primjenu gumica Klase II i III, obrazne maske, podbradak kape, a i još neki autori navode slična razmišljanja (36,37).

Janson i Hasund (38) na uzorku od 30 pacijenata Klase II/1 tretiranih s ekstrakcijom premolara i 30 bez nje nalaze bolje stanje u osoba u kojih nije bilo ekstrakcije. Zaključuju da u pacijenata kod kojih nije bilo ekstrakcije, gdje je liječenje provedeno aktivatorom i fiksnom ortodontskom napravom, nastaje dobra funkcionalna prilagodba, te da treba dati prednost liječenju bez vađenja kad god je to moguće.

Za razliku od gore navedenih anegdotalnih izvješća koji se ne temelje na egzaktnim istraživanjima, temeljiti klinički eksperimenti koji su provedeni ne podupiru hipotezu o ortodontskom liječenju kao uzročniku TMD-a.

Luecke i Johnston (39) proveli su istraživanje na 42 pacijenata s Klasom II/1, prosječne dobi od 15,3

godina, liječenih fiksnom standard-edgewise tehnikom, a u kojih su izvađeni gornji prvi premolari. Rendgenkefalometrijska raščlamba provedena je kako bi se uvrstile promjene u položaju kondila te promjene u položaju baze mandibule. Može se zaključiti da će samo u onih pacijenata u kojih nastaje distalizacija gornjih bukalnih segmenata postojati rizik od nastanka smetnji TMZ-a. Autori navode da je u 70% ispitanika nastao određeni mezijalni pomak mandibule, a u 30% njezin distalni pomak. Zaključuju da promjene u položaju kondila nisu u svezi s retruzijom sjekutića te da gotovo i nema mogućnosti da pomak mandibule ugrožava zdravlje orofacijalne regije.

Sadowsky (7) na temelju longitudinalne studije podupire tvrdnju da ekstrakciju ne treba dovoditi u svezu s povećanjem rizika od nastanka TMD-a.

Dibbets i van der Weele (40) proveli su longitudinalno ispitivanje na 87 ekstrakcijskih i 68 neekstrakcijskih pacijenata s Klasom I i Klasom II, ali i 15 godina nakon završenog ortodontskoga liječenja ne nalaze porast patoloških simptoma TMZ-a. Jedina statistički značajna razlika bila je u subjektivnom osjećaju pucketanja koje je bilo češće u onih pacijenata u kojih je provedena ekstrakcija, ali autori to pripisuju različitom smjeru rasta mandibule u tih pacijenata. Stanje je bilo isto ili čak poboljšano u 96% pacijenata liječenih bez ekstrakcije i u 92% s ekstrakcijom. Autori ne nalaze klinički znatne razlike u TMZ-u u pacijenata liječenih s ekstrakcijom i bez nje.

Årtun, Hollender i Truelove (41) ispitali su hipotezu da se u pacijenata liječenih s ekstrakcijom prvih premolara u gornjoj čeljusti češće javlja posteriorni položaj kondila. Istraživanje je provedeno na 29 pacijenata s Klasom II/1 liječenih s ekstrakcijom maksilarnih prvih premolara, te 34 pacijenta s Klasom I liječenih bez ekstrakcije. Rezultati ne pokazuju da osobe liječene s ekstrakcijom gornjih prvih premolara imaju veći postotak posteriornoga pomaka kondila.

O'Reilly i Rinchuse (42) ne nalaze razliku u znakovima i simptomima TMD-a između pacijenata liječenih s ekstrakcijom premolara i uz uporabu intermaksilarnoga gumenog vlaka Klase II te onih koji su liječeni bez ekstrakcije. Istraživanje je provedeno na 60 ortodontskih pacijenata u kojih je provedena terapija "straight wire" fiksnom tehnikom uz uporabu intermaksilarnoga gumenog vlaka Klase II.

U 34 pacijenta izvađeni su samo gornji prvi premolari, a u 12 pacijenata izvađena su sva četiri prva premolara. Kontrolna skupina sastojala se je od 60 pacijenata u kojih nije bilo ortodontskog liječenja.

Zaključci

Na temelju iznesenog pregleda literature mogu se dati sljedeći zaključci:

1. Temporomandibularna disfunkcija javlja se i u zdravih osoba, i to i u djece i u adolescenata.
2. Postotak simptoma TMD-a raste porastom dobi, osobito u adolescenciji, te opada oko 50 godine života.
3. Ortodontsko liječenje provedeno tijekom adolescencije ne smanjuje niti ne povećava mogućnost razvoja TMD-a poslije u životu.
4. Ne postoji dokaz o povećanom riziku od TMD-a pri provedbi bilo koje vrste ortodontskog liječenja.
5. Ekstrakcija premolara te upotreba intermaksilarnoga gumenog vlaka ne povećava rizik od nastanka disfunkcije.
6. Nema dokaza da ortodontsko liječenje može prevenirati niti izliječiti TMD.

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Orthodontic Treatment and Temporomandibular Dysfunction

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Summary

Orthodontists are concerned about the possibility of a link between the treatment they provide and temporomandibular disorders (TMD). The purpose of this article was to review the literature relating to orthodontic treatment of problems in the temporomandibular joint (TMJ). From the presented literature the suggestion that orthodontic treatment leads to TMD by causing distal condylar displacement appears to be ill-founded. Clinical studies suggest that orthodontic treatment has little role to play in worsening or precipitating TMD when treated patients are compared with untreated individuals, with or without malocclusion, or when different types of orthodontic treatment are compared. Indeed, longitudinal studies tend to show a reduction in TMD signs in orthodontically treated individuals.

Key words: *orthodontic treatment, temporomandibular dysfunction*

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REVIEW

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The potential detrimental effects of orthodontic treatment in the management of temporomandibular disorders (TMD) has captured the attention of the orthodontic community over the last decade. However, despite the abundance of studies, the question continues to trouble the orthodontist.

The purpose of this report is to present a review of literature about the possibility of a relationship between orthodontic treatment and temporomandibular disorders.

Different types of orthodontic treatment have been considered as risk etiological factors that can produce a distal displacement of the condyle that leads to a variety of disorders of the temporomandibular joint and surrounding anatomical structures (1).

The relationship between occlusion and TMD has been controversial in the literature. Some authors have reported that occlusion is a primary etio-

logical factor in the development of TMD (2,3). Others have suggested that occlusion is not involved, or plays a minor role in the problem. The cause of TMD is viewed as multifactorial (4,5).

Many epidemiological studies have stated that clinical symptoms such as pain, muscle tension, joint noises and irregularities of mandibular movement may appear subjects who had never undergone orthodontic treatment. Symptoms and signs are also affected by ethnicity, social class and psychological status (6-9).

Studies of the prevalence of mandibular dysfunction in children and adolescents have also shown that subjective symptoms and clinical signs are rather common and increase with age. Clinical symptoms of TMJ disorders have been reported to affect as many as 75% of the young adult population (10-13). Egemark-Ericson, Carlson and Ingervall

(14) noted that the prevalence of symptoms increased from 30% to 60% between 7 and 15 years and symptoms tend to be more prevalent in females than in males. As the prevalence of symptoms depends on criteria, diagnostic procedures and the sample used in the study, longitudinal investigations are the most reliable (15).

Historically, orthodontists were primarily oriented to treating adolescents. In the last two decades the number of children in mixed dentition and adult patients needing orthodontic treatment has increased. Demands for better facial esthetics and the development of sophisticated techniques (implants, guided tissue regeneration etc.) have increased the need for orthodontic treatment in older patients, which is the reason for the larger number of patients that suffer from TMD.

Temporomandibular dysfunction is a collective term embracing a number of subjective symptoms and clinical signs that involve the temporomandibular joint and surrounding structures, and is considered a major cause of nondental pain in the orofacial region (1).

The definition of TMJ disorder or dysfunction is an area of confusion. Van der Weele and Dibbets (16) stated: "... many different definitions of TMJ dysfunction have come into existence and, consequently, even in a single individual the diagnosis of TMJ dysfunction depends on the definition used."

Many of the studies investigating TMJ problems use the Helkimo clinical dysfunction index (DI) (17), which was originally designed as an epidemiological tool (18). It is based on five clinical symptoms: irregularities in mandibular movement, irregularities in TMJ function, muscle pain, TMJ pain, pain in movements of the mandible. Each symptom or sign investigated is scored as 0,1 or 5. Score could be 0-25. 0=symptom free, 1-4=mild dysfunction, 5-9=moderate dysfunction, 10-25= severe dysfunction with luxation, pain and decreased mandibular movement.

Other indices do exist, such as the craniomandibular index, but it needs careful standardization and is also a lengthy procedure to use, and is probably more cumbersome than the Helkimo index. For these reasons, it may be that this index appears to have had little use in the orthodontic literature (18).

TMD in orthodontically treated and non-treated subjects

Sadovsky and Be Gola (5) were the first authors to have undertaken an investigation with the main purpose of answering the question, does orthodontic treatment with fixed or removable appliances increase the risk of TMD. They did not find statistically significant difference between treated and untreated subjects and concluded that orthodontic treatment with fixed appliances in adolescence does not increase the risk of TMD.

The situation prior to 1988 was summed up by Gianelly (19), who suggested that the evidence indicating that orthodontics had caused long-term sequel of TMD was based largely on anecdotal reports. Recently, however, because of more severe criteria and better evidence the results have become reliable.

Koch (20) found orthodontically treated adolescents to be symptom-free as often as untreated individuals.

Smith and Freer (21) examined 87 patients who had received full fixed appliances during adolescence with an untreated control group. There were no statistically significant differences between the investigated groups; the one exception was the finding of a higher rate of soft clicks in the postorthodontic group. Their results rejected the hypothesis of association between orthodontic treatment and TMD.

Egemark and Thilander (10) conducted a longitudinal study of 293 children aged 7,11 and 15. After a ten-year period subjects who had been orthodontically treated showed less subjective symptoms, and the Helkimo clinical dysfunction index were significantly lower in these groups. Joint sounds also did not appear as often in the orthodontically treated subjects.

Olsson and Lindqvist (22) conducted a longitudinal study of 210 patients, orthodontically treated with fixed appliances. Before the orthodontic treatment, symptoms of TMD were found in 17% and after treatment in 7% of the patients. In this study it was found that orthodontic treatment in many patients prevented further development of and/or cured TMD.

Hirata, Heft, Hernandez et al. (6) in their study measured the prevalence and incidence of signs of

TMD in a group undergoing orthodontic treatment, comprising 102 patients, mean age 15.3 years. An untreated control group of 41 nonorthodontically treated subjects, mean age 16.2 years, was used. The incidence of TM signs for both groups was not significantly different.

Kremenak et al. attempted to discover relationship between orthodontic treatment and TMD from a prospective longitudinal study. Treatment was performed by fixed edgewise appliances. The sample consisted of 109 patients, aged 16-25 years. Helkimo's method was used to collect TMD data before, and at annual intervals after, treatment. In 90% of the patients Helkimo scores stayed the same or improved, and 10% had scores that increased. They conclude that orthodontic treatment was not an important etiologic factor for TMD in their sample (23,24).

Keß (25) compared 54 orthodontic patients with 52 subjects that had not been orthodontically treated. All individuals investigated were 20-30 years old. According to Helkimo's definition, about 50% of the untreated subjects showed limitation of mandibular mobility during lateral movement; the orthodontically treated sample, however, showed limitation in only 16%. In the treated sample, the masseter, lateral pterygoid, and temporal muscles showed, a significantly smaller frequency of pressure pain during the clinical investigation. Tenderness of the TMJ during mouth opening occurred twice as often in the untreated sample. With Helkimo's clinical index, 35% of treated and only 10% untreated sample could be evaluated symptom free.

Pancherz (26) evaluated the effects of the Herbst fixed functional appliance in the treatment of 22 growing patients with Class II/1 and reported that the number of subjects with tenderness to palpation doubled during the initial 3 months of treatment. However, after appliance removal, most muscle symptoms disappeared and 12 months posttreatment the number of subjects with symptoms was the same as before treatment.

Paesani (27) made magnetic resonance images in 115 patients with symptoms of TMD. In 78% of the investigated sample he found different stages of uni- or bilateral disturbances, such as displacement of the disk with or without reduction or arthrosis.

In a survey of 369 Israeli school children Lieberman, Gazit, Fuchs et al. (28) found no associa-

tion between previous orthodontic treatment and increased symptoms of mandibular dysfunction.

Larsson and Ronnerman (29) studied 23 Swedish adolescent patients who had been orthodontically treated 10 years previously, 18 of whom had fixed appliances and 5 of whom had a miofunctional appliance. In 31% of the subjects mild dysfunction was recorded clinically and only one subject (4%) had severe dysfunction according to the Helkimo index. They concluded that orthodontic treatment could be performed without fear of creating complications of TMD, and that it may possibly prevent it.

As a rule, orthodontic treatment should not be performed when orofacial pain is present and we have to determine if TMJ condition is the reason for that pain. After the pain disappears the best time to start with orthodontic treatment is after 6 months (9).

Patients with generalized musculoskeletal pain (systemic diseases, rheumatic arthritis etc.) should be examined by a rheumatologist, and the orthodontic treatment should be discussed with a specialist.

If TMJ pain begins during orthodontic treatment, the forces produced by extraoral traction and intermaxillary elastics should be minimized or eliminated, and after TMD symptoms disappear active therapy can be continued.

From the presented literature the suggestion that orthodontic treatment leads to TMD by causing distal condylar displacement appears to be ill-founded. Clinical studies suggest that orthodontic treatment has little role to play in worsening or precipitating TMD, when treated patients are compared with untreated individuals with or without malocclusion, or when different types of orthodontic treatment are compared. Indeed, longitudinal studies tend to show a reduction in TMD signs in orthodontically treated individuals (22,30,31).

Class II elastic and premolar extractions and TMD

Class II elastics and maxillary premolar extractions have recently been implicated as causes of TMD, which is probably the reason why extractions decreased from 37.7% five years ago to 29.3% (6).

Orthodontic therapy involving maxillary incisor retraction is said to lead to a posteriorly positioned condyle and TMD.

Witzig and Spahl (32) stated that premolar extractions belong to the past because of an increased vertical dimension with posteriorly positioned condyle that is a frequent predisposing factor in TMD.

Farrar and Mc Carty (34) believed that a posteriorly positioned condyle is a frequent predisposing factor in anterior TMJ disk displacement, Grummons (35) alleged that Class II and III, mandibular headgears, facial masks and chin sups can cause TMD. Similar viewpoints have been by expressed other authors (36,37).

On a sample of 30 Class II/1 patients treated with and 30 without, premolar extractions Janson and Hansund (38), found better joint condition in patients treated without extraction. They summarized that in patients treated without extractions, with fixed or removable appliances good functional adaptation persists, and that this type of therapy should be preferred.

Experimental studies, which support the proposition that orthodontic therapy is not causative of TMD are contrary to the aforementioned anecdotal clinical reports.

Luecke and Johnston (39) investigated 42 Class II/1 patients, treated with two maxillary premolar extractions and fixed edgewise appliances (mean age 15.3 years). They used cephalometric radiographs to assess not only changes in condylar position but also changes in mandibular basal bone position. Approximately 70% of the present sample underwent varying degrees of forward mandibular displacement; 30% of the sample underwent distal. They concluded that changes in condylar position were not correlated with incisor retraction, and that there is almost no possibility of mandibular displacement being a threat to orofacial health.

Sadowsky (7) concluded, as a result of prospective longitudinal study, that premolar extraction should not be considered a risk factor with respect to increase of TMD symptoms.

The study of Dibbets and van der Weele involved 87 patients with premolar extractions and 68 without extraction (Class I and II). They reported signs and symptoms from 1 to 15 years after the start of treatment. There were no clinically important

differences between groups. A statistically significant difference was found in the frequency of subjectively perceived clicking in patients treated with extraction, which the authors attributed to differences in growth pattern. Conditions were the same or improved in 96% patients without and 92% patients with extraction (40).

Årtun, Hollender and Truelove (41) tested the hypothesis that patients with maxillary premolar extraction more often have posterior condylar position. The sample consisted of 29 patients treated for Class II/1 Angle with extraction of maxillary first premolars and 34 patients treated for Class I Angle without extraction. The results do not suggest increased prevalence of posteriorly located condyles in patient treated with extraction only of maxillary premolars.

O'Reilly and Rinchuse (42) treated 60 patients with "straight wire" orthodontic mechanotherapy that included Class II elastics. The control group consisted of 60 untreated subjects. In the treated group 34 subjects had only maxillary first premolar extractions, whereas 12 subjects had extractions of four first premolars. They concluded that Class II elastics and extractions have little or no effect on general TMD signs and symptoms.

Conclusions

From the presented review of the literature it can be concluded that:

1. Temporomandibular dysfunction is also present in healthy, orthodontically untreated children and adolescents.
2. The prevalence of TMD symptoms increased with age, especially during adolescence, and decreased at the age of 50.
3. Orthodontic treatment during adolescence does not increase or decrease the possibility of TMD later in life.
4. There is no evidence of a greater risk for TMD in subjects treated with different kinds of orthodontic appliances.
5. Extractions of premolars and Class II elastics does not lead to TMD.